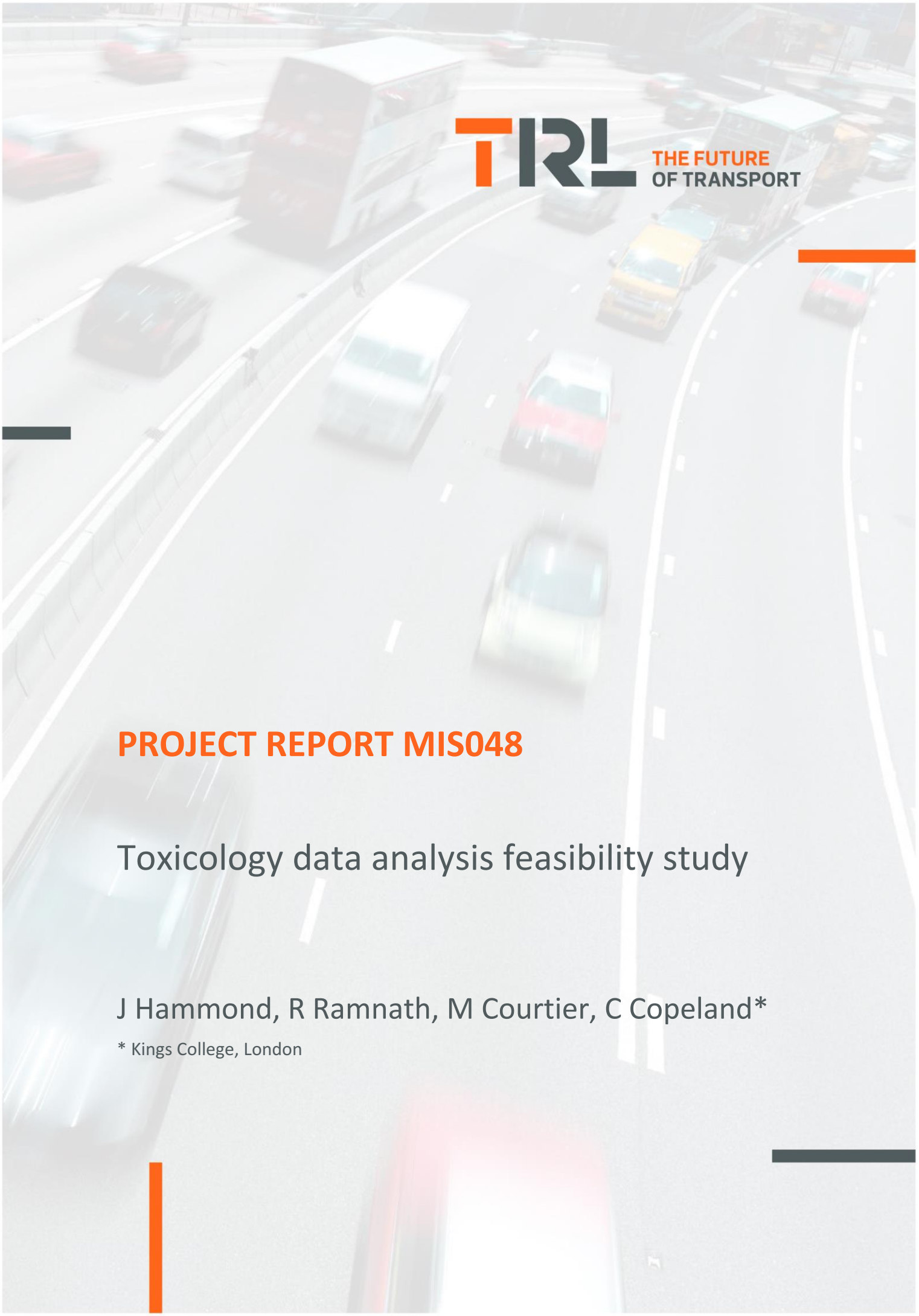

THE FUTURE OF TRANSPORT

PROJECT REPORT MIS048

Toxicology data analysis feasibility study

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Executive summary

This report presents the results of a feasibility study into how the drug toxicology data for road traffic fatalities currently collected by TRL can be used by the Department for Transport (DfT). This work has been carried out by TRL in collaboration with Caroline Copeland, Kings College, London, Director of the National Programme for Substance Abuse Deaths (NPSAD).

TRL currently collects Blood Alcohol Content (BAC) and drug toxicology data for road traffic fatalities in Great Britain from coroners and procurators fiscal, on behalf of DfT. The BAC data collected is analysed and used by DfT in their publication of drink driving statistics[1] but currently the toxicology data is not able to be used in the same way. This is because these data are more complex, the data are collected in a variety of ways, and it has not been possible to have sufficient confidence in understanding of the data.

Data used in this study

Table 1 shows the number of fatalities recorded in Stats19 and the number that had drug data available for analysis over the five-year period 2014-18. Overall drug data was available for 4,926 fatalities (57% of those recorded in Stats19), but in 2,016 of these no drugs were detected. 59% of fatalities with drug data available had at least one drug detected.

Table 1: Number of fatalities in Stats19 and drug data available (2014-18)

	Number	% of Stats19	% of fatalities with drug data available
Number of adult fatalities in Stats19	8,602	100%	-
Fatalities with drug data available (includes drugs tested for, but none found)	4,926	57%	100%
Fatalities with at least one drug detected	2,910	34%	59%

Methodology

This project encompassed two main tasks to further understand the existing toxicology data and identify what next steps may be required to make the data more usable in the future.

The first of these tasks was analysis of drug data collected for road traffic fatalities from 2014 to 2018. Existing NPSAD coding was used to classify the drugs detected into ten groups, as shown in Table 2. This includes a distinction between psychoactive and non-psychoactive drugs which allows drugs to be identified which would have had the potential to impair driving.

One of the ten groups comprised those drugs which could have been administered before the collision or administered afterwards as a treatment by emergency medical personnel (e.g. ketamine). This group was of particular interest because being able to determine whether a drug was taken before or after the collision is important in understanding the number of collisions where a driver was under the influence of a drug with potential to impair. Therefore,

[1] Reported drinking and driving (RAS51) https://www.gov.uk/government/statistical-data-sets/reported-drinking-and-driving-ras51

further analysis was carried out looking at combinations of drugs detected to identify those where the drug detected was likely to have been medically administered after the collision rather than before. Following this further analysis, there remained 454 fatalities where the detected drug could not be categorised as either medically administered after the collision or administered by the individual beforehand – these are labelled as 'query psychoactive drugs' in Table 2, which shows the number of fatalities with a drug detected in each group.

Table 2: Number of fatalities with drugs detected by drug category, 2014-18

Drug group	Number of fatalities	% of fatalities with drug data available (4,926)
Non-Psychoactive medications (e.g. paracetamol)	1,191	24%
Psychoactive medications with low impairment potential (e.g. antidepressants)	667	14%
Psychoactive medications with impairment potential (e.g. benzodiazepines)	606	12%
Medical treatment drugs (e.g. ephedrine)	357	7%
Query psychoactive drugs[2] (e.g. morphine, ketamine)	454	9%
Drugs of abuse (e.g. cocaine)	983	20%
GHB[3]	3	<0.5%
Non-medical compounds[4]	674	14%
Compounds produced post-mortem	17	<0.5%
Total fatalities with drugs detected	**2,910**	**59%**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

Drugs of abuse were detected in 20% of all fatalities with drug data available. 14% of fatalities with drug data available had drugs detected with low impairment potential and 12% had drugs with impairment potential. The level of impairment depends on the amount of drug, the individual and the combination of other drugs, including alcohol.

Drug driving legislation

The number of fatalities with drugs detected above the legal limit for driving was also calculated. For some tests, toxicologists may carry out an initial test to indicate whether drug groups were present, which provides qualitative results such as 'detected' or 'not detected'; those that were detected may then be analysed further to identify the levels and the exact drugs present. The data collected by TRL highlighted that many drug detections are not recorded with a numeric level; this presents a challenge to the accurate production of

[2] Drugs that could be prescribed/abused or used in emergency treatment and have impairment potential

[3] Gamma-Hydroxybutyric Acid https://www.drugwise.org.uk/ghb/ All of these cases had a level <50mg/l which is likely to be a result of post-mortem production rather than ingestion

[4] These include nicotine and substances found in food, for example caffeine and theobromine (found in cocoa)

statistics about the number of fatalities above the drug driving limits. Table 3 shows the number of fatalities that had a drug detected above the legal limit; this could be considered a minimum value since numerical data was not available in all cases.

Table 3: Number of driver/rider fatalities with a drug in the drug driving legislation detected, and by whether the level was above the legal limit, 2014-18

Drug	Driver/rider fatalities with drug detected	Driver/rider fatalities above legal limit	Drivers/riders above the legal limit as a proportion of total fatalities with drug data available[5]
Ketamine	144	29	1%
Cocaine	241	74	2%
Benzoylecgonine[6]	226	148	4%
Cannabis	275	183	5%
Methamphetamine	4	0	0%
MDMA	34	14	<0.5%
Heroin	20	0	0%
LSD	0	0	0%
Amphetamines	63	19	1%
Morphine	153	45	1%
Clonazepam	1	0	0%
Lorazepam	3	0	0%
Methadone	41	8	<0.5%
Diazepam	106	16	<0.5%
Temazepam	53	1	<0.5%
Oxazepam	38	0	0%
Flunitrazepam	0	0	0%
Total	**832**	**396**	**12%**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

Drugs with ability to impair driving not in current legislation

Common psychoactive drugs detected that are not included in the current drug driving legislation were analysed. This highlighted that sedating antihistamines are relatively commonly detected in road traffic fatalities; more so than amphetamines and temazepam which are in the legislation. Sedating antihistamines[7] are not legislated and are mostly

[5] Percentage of drivers above the legal limit by total drivers/riders with drug data available (3,377)

[6] Cocaine metabolite

[7] Antihistamines – NHS https://www.nhs.uk/conditions/antihistamines/

available over the counter; their purpose is to induce sleep, and at therapeutic doses they are likely to impair ability to drive. There were also several fatalities with Z-drugs identified; these are drugs that are used to induce sleep and therefore driving whilst affected by these drugs could be very dangerous.

These findings demonstrate the value of toxicology data. Further analysis could assess the road user type and other characteristics of these cases to further understand the road safety risks of these drugs. Monitoring trends in psychoactive drugs that are not included in the legislation currently could also inform potential future updates to this regulation.

Representativeness of sample

The second task was to consider the representativeness of the sample, highlighting potential gaps or bias in the toxicology data which might influence the outcomes of any analysis carried out. This did not highlight any concerning bias or gaps in the data, although how coroners and Scottish Fatal Investigation Units (SFIUs) determine which fatalities are drug tested and for what drugs is unknown; there are also cases that are not available due to the files being sent for inquest or part of criminal proceedings. Further engagement with coroners and/or toxicologists would help with understanding their decision making and processes.

Drivers/riders had the highest proportion of drug data availability; this was to be expected and future analysis of drugs in road traffic collisions would generally be likely to focus on these road users. Drug data were available for 66% of car driver fatalities, and 68% of motorcyclist fatalities. There was lower availability of drug data for pedestrians and passengers. Fatalities in Scotland were more likely to have a drug detection recorded with both a numeric and a descriptive level compared with data from coroners in England. Some police forces were unable to provide drug data (Gwent) or had a low return of drug data (Metropolitan (32%), Hertfordshire (34%), West Midlands (32%)).

Next steps

The project found that analysing toxicology data can provide interesting and useful insight to DfT and it is recommended that these data continue to be collected and analysed using the NPSAD coding. An improvement to the way the data are recorded for this project in the database is also advised to assist with determining whether 'Query psychoactive drugs' detected were medically administered or not. This is to record in the database the presence of any interpretation included on the toxicology report which indicates whether the drug was likely to have been administered by medical staff.

Two possible further pieces of work have also been suggested. The first of these is a review of toxicology reports currently held by TRL to determine what additional information about the likelihood of query psychoactive drugs being medically administered (to support the recommendation made above). The second is engagement with coroners and Scottish Fatal Investigation Units (SFIUs) to gather more information about how decisions are made on whether drug testing is carried out for a fatality, and if it is, which tests and how drugs are recorded (numeric or descriptive levels) so that informed decisions can be made about the accuracy of statistics produced around the number of road traffic fatalities above the drug driving limits.

1 Introduction

The aim of the work presented in this report was to understand how toxicology data for road traffic fatalities can be robustly and accurately processed and analysed to improve confidence in the data and analyses and to assist DfT in decisions regarding whether or not and how any results could be published.

TRL collects data, on behalf of DfT, on blood alcohol content (BAC) and toxicology from a sample of fatalities in road traffic collisions from coroners and SFIUs. The BAC data are well understood and routinely analysed and published. The DfT has similar ambitions to routinely publish a summary of the toxicology data and perform routine analysis on the dataset. However, there are added complexities of the toxicology data that mean the DfT does not currently have sufficient confidence in their understanding of the data required for routine publication or analysis.

Two main tasks were carried out to help DfT further understand the toxicology data currently collected and how it could be used.

- **Analysis of toxicology data** (Section 2) – the aim of this task was to apply an existing coding to the toxicology data collected by DfT, classify the drugs detected into groups, and analyse the resulting data together with collision details from Stats19.
- **Representativeness analysis** (Section 3) – the aim of this task was to assess how representative the data currently collected is and to identify any potential bias or gaps in the data which might influence the outcomes of future analysis of these data.

This work has been carried out by TRL in collaboration with Caroline Copeland, Kings College, London, Director of NPSAD[8]. The NPSAD project collects data on drugs in fatalities from coroners and the team has developed a coding system to classify the drugs indicated from the toxicology report.

[8] National programme on Substance Abuse Deaths https://www.sgul.ac.uk/about/our-institutes/population-health/research-themes/health-lifestyle-and-environments/npsad

2 Analysis of toxicology data

The purpose of this task was to apply the NPSAD coding to the toxicology data collected by DfT, classify the drugs detected into groups, and analyse the resulting data together with collision details from Stats19.

This task involved applying the NPSAD coding to drug detection data from 2014-18 to classify fatalities into ten different drug groups. Section 2.1 describes the methodology used and Section 2.2 presents the resulting classification of fatalities. Further analyses were then done to provide examples of the results that could be achieved from analysis of the toxicology data. These analyses are presented in sections 2.3 and 2.4.

2.1 Methodology

This section describes the methodology used to apply the NPSAD coding to the toxicology data provided by TRL.

2.1.1 Data included

The analysis used the last five years of complete data (2014-2018) from the existing database of BAC and drug data for road fatalities collected by TRL. TRL records the level of drugs as given on the L407 report or toxicology report; these are sometimes numerical but often text descriptions. Each coroner may work with one or more different laboratories; each laboratory may offer different types of tests at different costs and report the results differently. For some drugs and initial screening may give a detected or not detected results, and then any specimens that have a drug detected may be analysed further to determine the level.

Drug data is requested for all adult fatalities; however, it is only available for approximately 57% of fatalities (Table 4). This is due to the required files being at inquest or the coroner or Scottish Fatal Investigation Unit unable to provide them for other reasons.

A dataset of drug detections was extracted by TRL for analysis using the NPSAD coding. A drug detection was defined as an instance of a drug being recorded for a fatality with a non-zero numerical level or one of the following descriptive levels (any sample type):

- Below therapeutic level
- Consistent with therapy
- Demonstrated
- Detected
- Detected at low therapeutic level
- Detected at therapeutic level
- Detected in a low level
- High concentration
- High therapeutic amount
- Higher than expected
- Identified
- Indicated
- Low
- Low concentration
- Low therapeutic amount
- Positive
- Possible presence
- Possible trace
- Present
- Strongly positive
- Sub-therapeutic amount
- Therapeutic amount
- Trace
- Very low concentration

The following descriptive levels were treated as non-detections:

- Negative,
- Not detected
- Nothing significant

The text descriptions are those used by different toxicology laboratories, which may depend on the type of test carried out. For example, 'therapeutic amount' might be a level in line with what would be expected from taking a drug as prescribed, but this could have an impairment effect for an individual (e.g. diazepam).

Table 4 shows the number of fatalities and driver/rider fatalities recorded in Stats19 and the number that had drug data available for analysis over the five year period 2014-18; drug data available includes those fatalities where drug testing was carried out but no drugs were found to be present.

Table 4: Number of fatalities in Stats19 and drug data available (2014-18)

		Number	% of Stats19	% of fatalities with drug data available
All adult fatalities	Number recorded in Stats19	8,602	100%	-
	Fatalities with drug data available (includes drugs tested for, but none found)	4,926	57%	100%
	Fatalities with at least one drug detected	2,910	34%	59%
Driver/rider adult fatalities	Number recorded in Stats19	5,243	100%	-
	Fatalities with drug data available (includes drugs tested for, but none found)	3,377	64%	100%
	Fatalities with at least one drug detected	1,963	37%	58%

Overall drug data was available for 4,926 fatalities (57% of those recorded in Stats19), but 2,016 of these no drugs were detected. 59% of fatalities with drug data available had at least one drug detected. Drug data was available for a slightly higher proportion of driver/riders (64%).

The dataset used for this study was the fatalities with at least one drug detected (2,910). The dataset also included the BAC level and time in hours between the collision and death, although the time between collision and death was not used as a factor when identifying drug detections. A drug was identified as detected using the criteria explained above only, there were no limits placed on whether the fatality had died within a certain number of hours of the collision. This is because some drugs are designed to have a high metabolisation rate, for example, some pain relief medications are formulated to act quickly, but do not last very long; whereas other drugs, for example some antihistamines have a 'one per day' formulation which means they metabolise more slowly and give relief over a longer time period.

2.1.2 NPSAD coding

The drug names in the TRL dataset were matched to those used by NPSAD. Where possible, metabolite detections were merged with detections of their parent drug for ease of analysis[9].

The NPSAD coding was then used to classify the drugs into ten categories:

- **Non-Psychoactive medications** (e.g. paracetamol, antibiotics)
- **Psychoactive medications with low impairment potential** (e.g. antidepressants)
- **Psychoactive medications with impairment potential** (e.g. benzodiazepines)[10]
- **Medical treatment drugs** (ephedrine, atracurium, midazolam, propofol, rocuronium, thiopentone)
- **Query psychoactive drugs** – drugs that could be prescribed/abused or used in emergency medical treatment (morphine, alfentanil, fentanyl, ketamine) and have impairment potential. They are 'query' since it is not known whether they were used before or after the collision
- **Drugs of abuse** (e.g. cocaine, LSD) – these are drugs that have no medical use according to The Misuse of Drugs Regulations 2001[11] and all drugs in this category have the ability to impair driving ability; dependent on the dose and the individual.
- **GHB**[12] – this can be produced post-mortem or abused (level dependent)
- **Non-medical compounds** (e.g. nicotine, caffeine)
- **Compounds produced post-mortem**

2.1.3 Further assessment of 'Query psychoactive drugs' cases

Once the initial drugs had been coded, the fatalities where a drug in the 'Query psychoactive drugs' category had been detected were examined more closely. There were 663 fatalities where a drug in the 'Query psychoactive drugs' category was detected (23% of total fatalities with drugs detected).

The combination of other drugs detected was used to determine whether the drug in the 'Query psychoactive drugs' category was likely to have been medically administered. If other drugs in the 'Medical treatment drugs' category were detected alongside the query drug, this was counted as evidence of medical intervention and the query drug was deemed to have been medically administered. The exception to this was cases where both ketamine and

[9] Exception: nordiazepam/desmethyldiazepam is a metabolite of both diazepam and chlordiazepoxide and therefore cannot be classed as one or the other so was classed as 'benzodiazepine'

[10] Drugs that fall into this category can of course be abused (e.g. benzodiazepines)

[11] Exception: Cocaine included here although it is used clinically in nasal surgery, but this is unlikely in RTC circumstances

[12] Gamma-Hydroxybutyric Acid https://www.drugwise.org.uk/ghb/

fentanyl were detected without any other medical treatment drugs. This is because both of these drugs can be abused as well as medically administered.

Table 5 shows the number of fatalities were one of the drugs in the 'Query psychoactive drugs' category was detected, split by whether there was evidence of medical intervention. Note that a fatality can have multiple drugs detected and therefore numbers and proportions in this table should not be summed.

Table 5: Breakdown of fatalities with drug detected in the 'Query psychoactive drugs' category, 2014-18

Drug		Number of fatalities	Proportion of fatalities in 'Query psychoactive drugs' category	Proportion of total fatalities[13]
All 'Query psychoactive drugs'	**Evidence of other medical intervention**	**209**	**32%**	**7%**
	No other medical intervention drugs	**454**	**68%**	**16%**
Ketamine & metabolites	Evidence of other medical intervention	144	22%	5%
	No other medical intervention drugs	233[14]	35%	8%
Fentanyl	Evidence of other medical intervention	31	5%	1%
	No other medical intervention drugs	23[15]	3%	1%
Alfentanil	Evidence of other medical intervention	39	6%	1%
	No other medical intervention drugs	2	0%	0%
Morphine & metabolites	Evidence of other medical intervention	95	14%	3%
	No other medical intervention drugs	244	37%	8%
TOTAL fatalities with drug in 'Query psychoactive drugs' category		**663**	**100%**	**23%**

The figures in Table 5 show that 32% of fatalities where there was a drug detected in the 'Query psychoactive drugs' category had evidence of other medical intervention and

[13] Total fatalities here is total fatalities 2014-18 with at least one drug detection

[14] Includes cases where fentanyl but no other medical drugs detected

[15] Includes cases where ketamine but no other medical drugs detected

therefore the query drug could be deemed to have been medically administered. This accounts for 7% of total fatalities with drugs detected.

This means that there remain 454 fatalities (16% of all fatalities with drugs detected) where a drug in the query group has been detected and it cannot be determined whether it was or was not administered as part of medical treatment.

Of the four drugs in the 'Query psychoactive drugs' category, morphine (& metabolites) and ketamine (& metabolites) accounted for the highest proportions of fatalities in the category where a query drug detected could not be identified as medically administered (35% and 37% respectively).

It is important to note that, whilst the presence of other medical treatment drugs has been used to determine whether a query drug was medically administered, the absence of other medical treatment drugs does not indicate that the query drug was abused. The information in the toxicology data as it is currently is not sufficient to determine if a query drug such as ketamine was abused, only whether it is likely to have been medically administered. A change to data collection that could improve the data analysis would be recording which drugs were administered by medical personnel and also those prescribed to the deceased – both of these things are often included in the toxicology reports. Changes to testing (or at least stipulations as to how testing is done) for some drugs of abuse would also be beneficial, as in some cases the limit of detection of the machines used for toxicology tests were higher than the specified drug-driving limit. In-depth data from hospitals or emergency services could also provide further information on medicines used in medical treatment, but would be complex to match up cases and extract the relevant data. The use of the amount of time between collision and death was explored but it was found that there was no methodical way to use this information to identify medically administered drugs.

2.2 Summary results

This section presents the summary results from the application of the NPSAD coding to the drug detections data. Throughout this section, the term 'total fatalities' is used to refer to the total number of adult (16+) fatalities between 2014 and 2018 where TRL received drug data and at least one drug was detected (2,910 fatalities). These 2,910 fatalities account for 59% of all adult fatalities where drug data was received[16] and 34% of all adult fatalities in GB. Individual coroners and Scottish Fatal Investigation units decide for each case which, if any, toxicology tests to request; the available resources may be a factor in determining test requirements. Section 3 explores the availability of drugs data for various casualty groups to investigate the representativeness of the drugs data.

Table 6 presents the total number of fatalities with drugs detected in each of the ten drug categories described in Section 2.1.2 and accounting for the further cleaning described in Section 2.1.3.

[16] Includes those fatalities where drugs were tested for but none were found

Note that a fatality can have drugs detected from more than one group and therefore the numbers and proportions presented should not be summed.

Table 6: Number of fatalities with drugs detected by drug category, 2014-18

Category	Number of fatalities	Proportion of total fatalities with drugs detected (2,910)	% of fatalities with drug data available (4,926)
Non-Psychoactive medications	1,191	41%	24%
Psychoactive medications with low impairment potential	667	23%	14%
Psychoactive medications with impairment potential	606	21%	12%
Medical treatment drugs	357	12%	7%
Query psychoactive drugs	454	16%	9%
Drugs of abuse	983	34%	20%
GHB	3	<0.5%	<0.5%
Attributable to GHB ingestion[17]	*0*	*0%*	0%
Non-medical compounds[18]	674	23%	14%
Compounds produced post-mortem	17	1%	<0.5%
Total fatalities with drugs detected	**2,910**	**100%**	**59%**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

As shown in Table 6, the most common drug group detected was 'Non-Psychoactive medications'; a drug from this group was detected in 41% of total fatalities with drugs detected and 24% of all fatalities were drug data were available. 'Drugs of abuse' was the second most common; detected in 34% of fatalities with drugs detected and 20% of fatalities with drug data available.

2.3 Detailed analysis of fatalities with psychoactive drugs

Further detailed analysis was carried out for those fatalities where a psychoactive drug was detected to explore what useful findings could be derived from the data. Psychoactive drugs are those which alter nervous system function resulting in aberrations in perception, cognition, consciousness, mood, or behaviour. Therefore, they are of interest in understanding drug driving collisions. Of the 2,910 fatalities with drugs detected, 1,625 (56%)

[17] GHB with level <50mg/l is likely to be a result of post-mortem production

[18] These include nicotine and substances found in food, for example caffeine and theobromine (found in cocoa)

had a psychoactive drug detected. This accounts for 33% of fatalities for which drug data were received by TRL[19].

Psychoactive drugs encompass the following categories discussed in the previous section:

- Psychoactive medications with impairment potential
- Query psychoactive drugs[20]
- Drugs of abuse

As part of the analysis the psychoactive drugs were grouped into sub-categories to help understand the common types of these drugs detected in road traffic fatalities, and what proportion are currently included in legislation. The sub-categories used were:

- Drugs already listed in drug driving legislation
- Other substances of concern – these are drugs which are not listed in the legislation but would also affect an individual's ability to drive safely. Examples include drugs with relatively high numbers of deaths which are either commonly prescribed (e.g. tramadol) or which are increasingly being abused (e.g. alprazolam).

Table 7 shows the number of fatalities with a drug detected in each of the psychoactive drug sub-categories.

[19] Includes those fatalities where drugs were tested for but none were found

[20] Not including cases where the query drug in question was deemed to have been medically administered (see Section 2.1.3)

Table 7: Fatalities with psychoactive drugs detected by category, 2014-18

Psychoactive drug sub-category	All fatalities		Driver/Rider fatalities[21]	
	Number	% of fatalities with psychoactive drugs	Number	% of fatalities with psychoactive drugs
Drugs in drug driving legislation	1,388	85%	832	76%
Other substances of concern	509	31%	311	28%
Codeine (with morphine)	*195 (87)*	*12% (5%)*	*128 (59)*	*12% (5%)*
Sedating antihistamines	*98*	*6%*	*60*	*5%*
Tramadol	*92*	*6%*	*65*	*6%*
Gabapentinoids (pregabalin/gabapentin)	*63*	*4%*	*38*	*3%*
Dihydrocodeine	*46*	*3%*	*33*	*3%*
Z-drugs (zolpidem/zopiclone)[22]	*40*	*2%*	*29*	*3%*
Fentanyl	*23*	*1%*	*15*	*1%*
Buprenorphine	*15*	*1%*	*5*	*<0.5%*
Alprazolam	*12*	*1%*	*5*	*<0.5%*
Total fatalities with at least one psychoactive drug	**1,625**	**100%**	**1,094**	**100%**
Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category				

Table 7 shows that the vast majority of fatalities with a psychoactive drug detected had a drug detected which is listed in the drug driving legislation. There were 832 driver/riders that had a drug detected that was in the drug driving legislation; this accounted for approximately three-quarters of fatalities with psychoactive drugs detected. More detail on this, including the number of driver fatalities with drugs detected at levels over the legal limit, is presented in Section 2.4.

When the number of fatalities with the individual drugs detected are examined in more detail and by casualty class (see table in Appendix A), it can be seen that sedating antihistamines were detected in a slightly higher number of fatalities than drugs such as amphetamines and temazepam which are listed in the drug driving legislation. In fact, when the numbers of detections of all sedating antihistamines are combined, this sub-category was the 7th most common drug type detected and 61% of fatalities (60 out of 98) with sedating antihistamines detected were drivers.

[21] Includes cyclists

[22] Z-drugs are drugs which induce sleep

This is of particular interest because these sedating antihistamines are available over the counter (except for hydroxyzine which is prescription only) and the public may not consider them as being a strong drug which could affect their ability to drive safely[23].

It is also interesting to note that 50% of the 509 fatalities which had a substance of concern detected also had a drug detected which is included in the drug driving legislation (252 fatalities). Future analysis could be done to explore further the levels of these legislated drugs which are detected in combination with other substances of concern. It would also be useful to investigate the levels at which the substances of concern are being detected in driver fatalities. This would help to judge how these substances of concern may be contributing to road traffic collisions.

2.4 Analysis with Stats19

Once the drug detections had been classified (as described in Section 2.1), the drug detection data was linked back up to Stats19 and extra information about the fatalities was extracted, such as casualty class and road user type. Analysis was carried out to determine what value the toxicology data can provide when analysed in conjunction with collision data.

This section presents the number of fatalities split by these Stats19 variables and the drug groups defined in Section 2.1.2. The 'Non-medical compounds' and 'Compounds produced post-mortem' have not been included in the tables in this section because they are not drugs which can be taken. The 'GHB' group has also not been included because of small numbers.

In a similar way to the previous section, the term 'total fatalities' is used to refer to the total number of adult fatalities between 2014 and 2018 where at least one drug was detected, unless specified otherwise.

2.4.1 Casualty class

Table 8 shows the number of fatalities by casualty class for the different drug groups detected. The percentages are based on total number of fatalities for that road user class. Note that toxicological analysis may have found multiple drugs or groups of drugs to be present in a fatality, and therefore the individual drug group totals should not be summed.

[23] NHS guidance states that some antihistamines may cause drowsiness https://www.nhs.uk/conditions/antihistamines/.

Patient Information Leaflets, for example those for a common antihistamine state "Chlorphenamine may make you feel drowsy, dizzy or have blurred vision. Make sure you are not affected before you drive or operate machinery" https://products.mhra.gov.uk/product/?product=CHLORPHENAMINE%204MG%20TABLETS

Table 8: Number of fatalities by drug group and casualty class, 2014-18

Drug group	Driver/Rider[24]		Passenger		Pedestrian		TOTAL fatalities with drugs detected
	Number	%	Number	%	Number	%	
Non-Psychoactive Medication	784	40%	142	45%	265	42%	1,191
Psychoactive Med - Low Impairment Potential	416	21%	54	17%	197	31%	667
Psychoactive Med - Impairment Potential	371	19%	51	16%	184	29%	606
Medical Treatment	207	11%	43	14%	107	17%	357
Drugs of Abuse	707	36%	117	37%	159	25%	983
Query Psychoactive Drugs	285	15%	47	15%	122	19%	454
Total fatalities with drugs detected	**1,963**	**100%**	**315**	**100%**	**632**	**100%**	**2,910**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

Of the 2,910 fatalities with drugs detected, 34% (983) were found to have taken drugs of abuse, and this included 36% (707) of drivers/riders. 21% (606) of the 2,910 fatalities were adjudged to have taken drugs which had potential to cause impairment, including 19% (371) of drivers/riders. 15% of drivers/riders (285) and passengers (47) and 19% of pedestrians (122) were reported to have Query Psychoactive Drugs.

2.4.2 Road user type

Table 9 shows the number of total fatalities by road user type and drug group detected.

[24] Driver/Rider includes drivers and riders of all vehicle types, include pedal cyclists. There were no horse riders in the sample.

Table 9: Number of fatalities by drug group and road user type, 2014-18

Drug group	Pedestrian	Pedal Cyclist	Motorcyclist[25]	Car Driver	Goods Vehicle Driver	Other Driver	Passenger
Non-Psychoactive Medication	265 (42%)	49 (39%)	221 (35%)	470 (44%)	35 (35%)	15 (48%)	136 (45%)
Psychoactive Med - Low Impairment Potential	197 (31%)	22 (17%)	117 (18%)	260 (24%)	12 (12%)	10 (32%)	49 (16%)
Psychoactive Med - Impairment Potential	184 (29%)	30 (24%)	112 (18%)	203 (19%)	21 (21%)	7 (23%)	49 (16%)
Medical Treatment	107 (17%)	35 (28%)	51 (8%)	105 (10%)	9 (9%)	7 (23%)	43 (14%)
Drugs of Abuse	159 (25%)	32 (25%)	248 (39%)	387 (36%)	42 (42%)	3 (10%)	112 (37%)
Query Psychoactive Drugs	122 (19%)	23 (18%)	94 (15%)	144 (13%)	17 (17%)	9 (32%)	45 (15%)
Total fatalities with drugs detected (100%)	**632**	**127**	**638**	**1,080**	**101**	**31**	**301**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

Percentages are percentage of column totals

Of the 638 motorcyclist fatalities, 39% (248) were found to have taken drugs of abuse, while 36% (387) of car drivers and 42% (42) of goods vehicle driver were also found to have taken drugs of abuse. 18% (112) of motorcyclists, 24% (203) of car drivers, and 21% (21) of good vehicle drivers were found to have drugs with impairment potential.

2.4.3 Casualty sex

Table 10 shows the number of fatalities by casualty class, sex and drug group detected.

[25] Includes motorcycle passengers

Table 10: Number of fatalities by drug group, casualty class and sex, 2014-18

Drug group	Driver/Rider		Passenger		Pedestrian	
	Male	Female	Male	Female	Male	Female
Non-Psychoactive Medication	639	145	61	81	164	101
Psychoactive Med - Low Impairment Potential	300	116	18	36	125	72
Psychoactive Med - Impairment Potential	293	78	22	29	120	64
Medical Treatment	172	35	15	28	78	29
Drugs of Abuse	674	33	91	26	137	22
Query Psychoactive Drugs	242	43	23	24	81	41
Total fatalities with drugs detected	**1,682**	**281**	**171**	**144**	**432**	**200**
Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category						

Among drivers, 40% (674) of males and 12% (33) of females were found with drugs of abuse. 17% (293) of male drivers and 28% (78) of female drivers were found to have drugs with impairment potential.

2.4.4 Driver age

Table 11 shows the numbers of driver fatalities by drug group and age.

Table 11: Number of driver/rider fatalities by drug group and age, 2014-18

Drug group	16-19	20-24	25-29	30-39	40-49	50-59	60+	Total
Non-Psychoactive Medication	24	72	65	120	117	116	270	784
Psychoactive Med - Low Impairment Potential	8	32	41	66	92	69	108	416
Psychoactive Med - Impairment Potential	5	21	28	78	80	67	92	371
Medical Treatment	15	36	24	29	32	25	46	207
Drugs of Abuse	46	169	164	184	100	38	6	707
Query Psychoactive Drugs	23	42	39	92	71	39	148	454
Total fatalities with drugs detected	**96**	**274**	**270**	**358**	**317**	**237**	**411**	**1,963**
Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category								

48% of 16-19 year olds, 62% (169) of 20-24 year olds, 61% (164) of 25-29 year olds, and 51% of 30-39 year olds were found to have drugs of abuse. Table 11 also shows that older driver fatalities are more likely to have drugs in the psychoactive medications group detected whereas drugs of abuse are more likely to be detected in younger drivers. A high proportion of driver/riders aged 60+ were found to have 'query psychoactive drugs'; these drugs which have the ability to impair driving ability includes drugs such as morphine and fentanyl which are two drugs commonly prescribed for chronic pain conditions, and older individuals are at greater risk of developing such conditions.

2.4.5 Time of collision

Table 12 shows the numbers of fatalities by drug group, casualty class and time of collision.

Table 12: Number of fatalities by drug group, casualty class and time of collision, 2014-18

Drug group	Driver/Rider		Passenger		Pedestrian	
	10pm-4am	4am-10pm	10pm-4am	4am-10pm	10pm-4am	4am-10pm
Non-Psychoactive Medication	101 (30%)	683 (42%)	35 (39%)	107 (48%)	50 (30%)	215 (46%)
Psychoactive Med - Low Impairment Potential	57 (17%)	359 (22%)	12 (13%)	42 (19%)	46 (28%)	151 (32%)
Psychoactive Med - Impairment Potential	51 (15%)	320 (20%	15 (17%)	36 (16%)	47 (28%)	137 (29%)
Medical Treatment	28 (8%)	179 (11%)	7 (7%)	36 (16%)	24 (14%)	83 (18%)
Drugs of Abuse	202 (60%)	505 (31%)	48 (53%)	69 (31%)	77 (46%)	82 (18%)
Query Psychoactive Drugs	41 (12%)	244 (15%)	10 (11%)	37 (16%)	28 (17%)	94 (20%)
Total fatalities with drugs detected (100%)	**336**	**1,627**	**90**	**225**	**166**	**466**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

Among driver/riders, 60% (202) of fatalities with time of accident between 10pm and 4am and 31% (505) of fatalities with time of accident between 4am and 10pm had drugs of abuse detected. It is clear from Table 12 that fatalities involved in collisions between 10pm and 4am were more likely to be under the influence of drugs of abuse, drugs causing impairment or alcohol than fatalities involved in collisions between 4am and 10pm.

2.4.6 *Drugs in drug driving legislation*

In 2015 the government introduced limits in England and Wales for driving for 17 drugs: eight prescription drugs and nine illicit drugs (including amphetamines)[26]. In 2019 the same limits were introduced in Scotland[27].

These illicit drugs are listed in the top half of Table 13 and prescription drugs in the lower half of the table. This shows:

a) the number of driver fatalities with these 17 drugs detected (either as a text description (see Section 2.1 or a numeric level)

b) the number of fatalities which had a numeric level recorded

c) the percentage of fatalities with each drug detected that had a numeric level (b/a)

d) the number of fatalities where the numeric level was above the legal limit

e) The percentage of fatalities with a numeric level of each drug for which the numeric level was above the limit (d/b)

f) The percentage of total driver/rider fatalities with drugs detected found to be above the legal limit (d/1,963).

g) The percentage of total driver fatalities with drugs tested found to be above the legal limit (d/3,377)/rider

Note that the number of fatalities with ketamine and morphine in this table does not include fatalities where the drug was deemed to have been medically administered.

[26] https://www.gov.uk/government/collections/drug-driving

[27] https://www.legislation.gov.uk/ssi/2019/83/made

Table 13: Number of driver fatalities with a drug in the drug driving legislation detected; by drug, whether a numeric level was recorded, and whether the level was above the legal limit, 2014-18

Drug	Driver/rider fatalities with drug detected (a)	Driver/rider fatalities with numeric blood level recorded		Driver/rider fatalities above legal limit			
		Number (b)	% of total with drug detected (c)	Number (d)	% with numeric level (e)	% of total with drugs detected (f)	% of total with drugs tested (g)
Ketamine	144	31	22%	29	94%	1%	1%
Cocaine	241	97	40%	74	76%	4%	2%
Benzoylecgonine[28]	226	166	73%	148	89%	8%	4%
Cannabis	275	222	81%	183	82%	9%	5%
Methamphetamine	4	0	0%	0	-	0%	0%
MDMA	34	16	47%	14	88%	1%	<0.5%
Heroin	20	0	0%	0	-	0%	0%
LSD	0	0	-	0	-	0%	0%
Amphetamines	63	29	46%	19	66%	1%	1%
Morphine	153	85	56%	45	53%	2%	1%
Clonazepam	1	0	0%	0	-	0%	0%
Lorazepam	3	1	33%	0	0%	0%	0%
Methadone	41	27	66%	8	30%	<0.5%	<0.5%
Diazepam	106	70	66%	16	23%	1%	<0.5%
Temazepam	53	32	60%	1	3%	<0.5%	<0.5%
Oxazepam	38	27	71%	0	0%	0%	0%
Flunitrazepam	0	0	-	0	-	0%	0%
Total	**832**	**530**	**64%**	**396**	**75%**	**20%**	**12%**

Note that numbers and percentages in this table should not be summed because each fatality can be in more than one category

In total 20% of driver/riders with drugs detected (12% of drivers with drug data available) had a level above the legal limit. The most common drugs detected in driver fatalities are cannabis, benzoylecgonine and cocaine. All the other drugs in the drug driving legislation were detected in less than 3% of driver fatalities between 2014 and 2018.

However, it is important to consider what proportion of fatalities have drugs in the drug driving legislation recorded with a numeric level, as these fatalities are the only ones where it is possible to determine if the drug was detected at a level above the legal limit. The number

[28] Cocaine metabolite

of fatalities with numeric levels recorded varies considerably between the different drugs listed in the table above. The rate of numeric level recording is high for some drugs (cannabis 81%, benzoylecgonine 73%, oxazepam 71%) but much lower for others (for example, only 31 of the 144 fatalities where ketamine was detected had a numeric level recorded).

This presents a challenge for accurately reporting on the levels of drug driving. In order to be confident in the number of fatalities identified as over the limit for a certain drug, the numeric level would need to be known for a large proportion of the detections of that drug. The text descriptions and their meanings varies for different toxicology laboratories; the toxicology forms sometimes include analysis that indicates whether the drugs found may have impaired.

It is also interesting to note that the proportion of fatalities with a numeric level where the level is above the legal limit is much higher for illicit drugs than prescription drugs. This could suggest that tests which give numerical results are more likely to be requested if it is suspected that a fatality was over the legal limit. Also the legal limit for the illicit drugs are set relatively low for a 'zero tolerance' approach.

3 Representativeness analysis

This section investigates whether different factors have affected whether and how toxicology data is recorded. These factors include:

- Year of data collection
- Police force area and country
- Road user type
- Presence of the "Impaired by drugs" contributory factor
- Whether alcohol was tested for or present
- Elapsed time between accident and death

Some cells in the tables in this section have been shaded to highlight outliers from the mean value. The shading is done separately for each column using the following method:

Cell shading key:

Mean - Max deviation	Mean	Mean + Max deviation

For each column, 'max deviation' is defined as the number of percentage points between the mean percentage value for the column and the highest or lowest percentage value in the column (whichever is further from the mean). Values very close to the mean are therefore not shaded.

3.1 Year

The data analysed here was collected for fatalities for the period 2014 to 2018. Table 14 shows the number and percentage of fatalities which have Blood Alcohol Content (BAC) or drug data for the years of data collection. The percentages are compared to the total number of fatalities recorded in Stats19 for each year.

Table 14: Summary of fatalities with BAC and drug information by year.

Year	Fatalities in Stats19	Fatalities with BAC data		Fatalities with drug data	
		Number	% of Stats19	Number	% of Stats19
2014	1,722	1,046	61%	852	49%
2015	1,676	1,059	63%	914	55%
2016	1,723	1,048	61%	1,009	59%
2017	1,745	1,098	63%	1,097	63%
2018	1,736	1,108	64%	1,054	61%
Total	**8,602**	**5,359**	**62%**	**4,926**	**57%**
Max deviation			*2%*		*8%*

The proportion with BAC data has remained approximately constant at a mean value of 62%. The proportion of fatalities with drug data has increased from 49% in 2014 to levels similar to

the BAC data, at around 60% in recent years. An extended version of Table 14 is shown in Appendix B.1.

3.2 Police force area

Fatalities recorded in Stats19 include information about in which police force area the accident occurred. The number and proportion of fatalities with BAC and drug data is shown by police force area in Table 24 in Appendix B.2. The five highest and lowest police force areas by drug data are shown in this section in Table 15. In both tables, the percentages are compared to the total number of fatalities recorded in Stats19 for each police force area. The rows are sorted from the highest to lowest percentage with drug data.

It should be noted that the data is grouped by police force area to show geographic trends and should not be used to infer information about any specific police force.

Table 15: Summary of fatalities with BAC and drug information by police force area: Five highest and lowest returners of drug data (2014-18)

Police force code	Police force Name	Country	Fatalities in Stats19	Fatalities with BAC		Fatalities with drug data	
				Number	% of Stats19	Number	% of Stats19
94	Fife	Scotland	45	42	93%	42	93%
34	Northamptonshire	England	153	130	85%	133	87%
93	Tayside	Scotland	89	78	88%	77	87%
32	Lincolnshire	England	242	198	82%	199	82%
31	Nottinghamshire	England	140	113	81%	115	82%
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
20	West Midlands	England	263	92	35%	94	36%
41	Hertfordshire	England	125	63	50%	42	34%
1	Metropolitan	England	603	201	33%	193	32%
61	Gwent	Wales	81	12	15%	0	0%
48	City of London	England	4	0	0%	0	0%
Total			**8,602**	**5,359**	**62%**	**4,926**	**57%**
Max deviation					*62%*		*57%*

The proportion of fatalities with BAC and drug data varies significantly between police force areas but only one specific trend has been identified. That is that Scottish police force areas are amongst those for which there is the highest proportion of drug data obtained (two of the top five). The proportion of fatalities with BAC is higher than with drug data for most police force areas.

- Coroners in the Gwent police force area supplied some BAC data (15%), but no drug data.

- The Metropolitan Police has a large number of fatalities (603, accounting for 7% of all fatalities) and the coroners in London provided BAC data and drug data for approximately one-third of cases. The return rate was particularly low in 2014. There are a high proportion of pedestrian fatalities in London which may account for lower returns.

- Coroners in the West Midlands police force area returned a low level of drug data; this was especially low in 2015.

3.3 Road user type

The road user type was determined from the Stats19 information. Table 16 shows the number and proportion of the fatalities by this grouping along with whether BAC and drug data has been obtained. In this table the percentages are compared to the total number of fatalities recorded in Stats19 for each road user type. The rows are sorted from the highest to lowest percentage with drug data.

Table 16: Summary of fatalities with BAC and drug information by road user type (2014-18).

Road user type	No. in Stats19	Fatalities with BAC		Fatalities with drug data	
		Number	% of Stats19	Number	% of Stats19
Goods vehicle driver	241	182	76%	168	70%
Motorcycle rider	1,662	1,220	73%	1,128	68%
Car driver	2,754	1,991	72%	1,812	66%
Goods vehicle passenger	53	33	62%	30	57%
Pedestrian	2,090	1,130	54%	1,040	50%
Pedal cyclist	488	244	50%	216	44%
Other driver	125	59	47%	53	42%
Car passenger	1,079	455	42%	437	41%
Other passenger	49	20	41%	19	39%
Motorcycle pillion	61	25	41%	23	38%
Total	**8,602**	**5,359**	**62%**	**4,926**	**57%**
Max deviation			*21%*		*20%*

The road user types with the highest proportion of BAC and drug data are drivers and riders. This is followed by pedestrians and pedal cyclists. Passengers or pillion riders generally have the lowest proportion of BAC and drug data although goods vehicle passengers are an exception to this trend. The proportion of fatalities with BAC data is higher than those with drug data but both types of data follow a similar trend for availability. An extended version of Table 16 is shown in Appendix B.3.

3.4 'Impaired by drugs' contributory factor

For each collision recorded in Stats19, up to six factors are recorded which the police believe contributed to the collision. One of the contributory factors (CF) which can be assigned is 'Impaired by drugs'. This contributory factor can be assigned to either drivers/riders or pedestrians but only the instances of it being recorded for drivers are analyses here. Table 17 shows how the availability of drug data varies for the 'Impaired by drugs' contributory factor. Percentages are calculated as described in each row.

Table 17: The availability of drug data for driver fatalities (2014-18) by the whether the contributory factor 'Impaired by drugs' was assigned[29].

Contributary factor (CF) \ With drug data		Drug data available	Drug data not available	Total
'Impaired by drugs' CF not assigned	***No. with L407***	3,248	1,137	4,385
	No. of drivers/riders in Stats19			5,109
	% of Stats19 drivers/riders	64%	22%	86%
'Impaired by drugs' CF assigned	***No. with L407***	128	17	145
	No. of drivers/riders in Stats19			160
	% of Stats19 drivers/riders	80%	11%	91%

Only a small proportion (3%) of fatalities were assigned the 'Impaired by drugs' contributory factor. The proportion of fatalities with drug data is higher where the 'Impaired by drugs' contributory factor is assigned. This suggests that drug testing is potentially more likely to be requested if drug use if suspected by the police; however, the proportion of fatalities with the 'Impaired by drugs' factor recorded is very small so conclusions drawn should be treated with caution.

The proportion of fatalities where any information has been obtained with a L407 form does not vary significantly by the assignment of this contributory factor.

3.5 Alcohol recording and presence

The toxicology tests performed vary by fatality, and BAC and drugs are tested separately. This means either or both can be reported on L407 forms from coroners. Table 18 shows the availability of drug data by the BAC information received on L407 forms. This is only done for fatalities for which a L407 form has been received, which is 83% of the fatalities recorded in Stats19. The percentages in this table are compared to the total number of L407 forms received for each row.

[29] Contributory factor data only analysed for collisions where a police officer was in attendance

Table 18: The availability of drug data by BAC value and availability (2014-18).

BAC \ With drug data		Drug data available	Drug data not available	Total
< 11 mg/100mL[30]	***No. with L407***	3,391	451	3,842
	% of total	88%	12%	100%
>= 11 mg/100mL	***No. with L407***	1,323	194	1,517
	% of total	87%	13%	100%
>= 80 mg/100mL	***No. with L407***	901	117	1,018
	% of total	89%	11%	100%
Not available	***No. with L407***	212	1,590	1,802
	% of total	12%	88%	100%

For fatalities with a BAC value, approximately 87% also have drug information. This does not vary with the presence of alcohol which is defined as whether the BAC value is greater than or equal to 11 mg/100mL. For fatalities without BAC data only 12% have drug data. The drink driving limit in England and Wales is 80mg/100mL. Table 18 shows the percentage of fatalities which had drug data available is similar for both fatalities over the drink driving limit and those with alcohol detected at any level. This suggests that whether a fatality was over the drink driving limit does not affect how likely they are to have drug data recorded.

3.6 Elapsed time between collision and death

For fatalities where an L407 has been received, the date and time of collision and the data and time of death are known. Therefore, the elapsed time between the collision and death can be calculated. The availability of BAC and drug data has been found for different elapsed time periods after the collision and the number and percentage are shown in Table 19 and Figure 1. The results have been grouped by different elapsed time periods and it should be noted that these are not of constant width.

[30] 11mg/100mL used as limit of detection here to match NPSAD analysis

Table 19: Summary of fatalities with BAC and drug information (2014-18) by elapsed time between accident and death.

Time after collision*	No. with L407	No. with BAC	% of L407	No. with drug data	% of L407
0 - 1 hours	3,914	3,362	86%	3,080	79%
1 - 2 hours	618	501	81%	464	75%
2 - 3 hours	208	160	77%	143	69%
3 - 5 hours	210	164	78%	155	74%
5 - 8 hours	221	172	78%	160	72%
8 - 12 hours	209	158	76%	145	69%
12 - 24 hours	400	290	73%	260	65%
1 - 2 days	340	197	58%	184	54%
2 - 3 days	175	89	51%	90	51%
3 - 7 days	368	136	37%	130	35%
7 - 14 days	264	74	28%	62	23%
14 - 30 days	194	38	20%	34	18%
30 days +	24	3	13%	4	17%

*The bins include the left value and exclude the right value except 30 days + which includes all larger values.

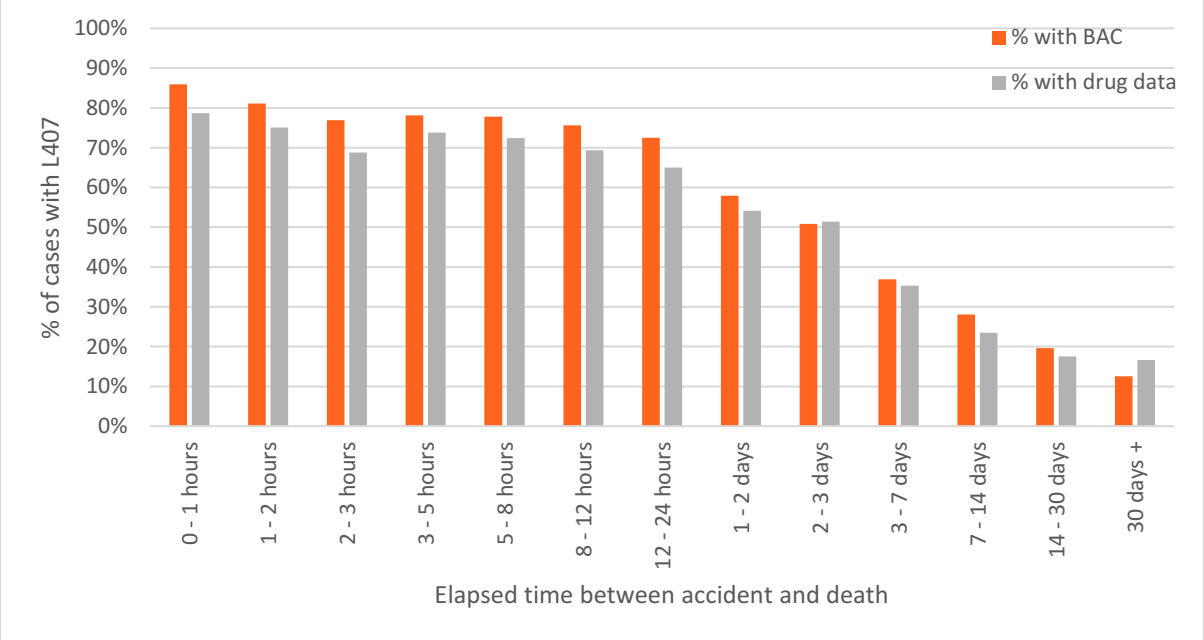


Figure 1: The percentage of fatalities with BAC and drug data (2014-18) for different elapsed times after death.

The largest number of fatalities occur within 1 hour of the accident. The percentage of fatalities with BAC data is above 70% and approximately constant for fatalities within 1 day of the accident. The proportion then steadily decreases as the elapsed time increases. The same pattern occurs for drug data but the percentages are slightly lower for all but the 30

days + time period. For analysis of BAC, only those fatalities that died within 12 hours of the collision are included; after this the data are not reliable. For drugs, the 'half-life' of drugs varies between drugs, and therefore no limit has been applied. The time between the collision and the death may influence the decision to request toxicology and the analysis undertaken.

3.7 Drug recording type

The drug data received from toxicology reports or L407 forms is recorded in either categorical or numerical forms. Categorical data is where the output of the toxicology analysis is reported in words. Numerical data is where the output of the toxicology analysis is reported as a numerical measure. Numerical data includes where the output is an inequality such as less than a numerical value. Toxicology reports often contain multiple tests which may output information about different drugs via either or both recording types. A single fatality may therefore have drug data recorded in multiple forms.

For each fatality in this analysis, it has been found whether any drugs were detected and recorded by a categorical method and whether any drugs were detected and recorded by a numerical method. Categorical values which are considered to be a detection include:

- Detected
- Present
- Positive
- Therapeutic amount
- Indicated
- High concentration
- Low concentration
- Strongly positive

3.7.1 Country

Table 20 shows how drug data has been recorded in different countries.

- In England the most common recording type is just categorical. This is followed by both categorical and numerical, and then just numerical.
- In Scotland the most common recording type is both numerical and categorical. This is followed by just numerical and then just categorical.
- In Wales both categorical and categorical and numerical are equally common recording types. They are followed by just numerical.

These results suggest the coroners in the different nations record the drug information in different ways; this may be due to different practices of individual coroners and the toxicology laboratories they use rather than a geographical or country factor.

3.7.2 Road user type

Table 21 shows how drug data has been recorded for different road user types. The rows are ordered by the percentage of cases with drug data. No strong trends have been observed suggesting drug recording methods do not vary by road user type. For almost all road user types, the percentage of cases with only a categorical level recorded is higher than the percentage with a numerical level and the percentage with both categorical and numerical levels.

Table 20: Summary of how drug data has been recorded by country (2014-18).

Country	No. with drug data	No. with drugs found	Both categorical and numerical		Just categorical		Just numerical		Neither categorical or numerical[31]	
			No. cases	% of drugs found	No. cases	% of drugs found	No. cases	% of drugs found	No. cases	% of drugs found
England	4,116	2,464	896	36%	1,417	58%	141	6%	10	0%
Scotland	587	324	175	54%	33	10%	116	36%	0	0%
Wales	223	111	52	47%	54	49%	5	5%	0	0%
Total	**4,926**	**2,899**	**1,123**	**39%**	**1,504**	**52%**	**262**	**9%**	**10**	**0%**
Max deviation				*17%*		*20%*		*18%*		*1%*

[31] For these cases, only the name of the drug was given with no qualification of the amount, either categorical or numerical.

Table 21: Summary of how drug data has been recorded by road user type (2014-18).

Road user type	No. with drug data	No. with drugs found	% of with drug data	Both categorical and numerical		Just categorical		Just numerical		Neither categorical or numerical[32]	
				No. cases	% of drugs found	No. cases	% of drugs found	No. cases	% of drugs found	No. cases	% of drugs found
Other driver	53	34	64%	14	41%	16	47%	4	12%	0	0%
Car passenger	437	271	62%	98	36%	139	51%	33	12%	1	0%
Motorcycle pillion	23	14	61%	3	21%	10	71%	1	7%	0	0%
Pedestrian	1,040	630	61%	257	41%	313	50%	57	9%	3	0%
Car driver	1,812	1,079	60%	402	37%	565	52%	110	10%	2	0%
Other passenger	19	11	58%	4	36%	4	36%	3	27%	0	0%
Pedal cyclist	216	125	58%	44	35%	74	59%	7	6%	0	0%
Goods vehicle passenger	30	17	57%	6	35%	11	65%	0	0%	0	0%
Goods vehicle driver	168	95	57%	42	44%	48	51%	4	4%	1	1%
Motorcycle rider	1,128	623	55%	253	41%	324	52%	43	7%	3	0%
Total	**4,926**	**2,899**	**59%**	**1,123**	**39%**	**1,504**	**52%**	**262**	**9%**	**10**	**0%**
Max deviation			*5%*		*17%*		*20%*		*18%*		*1%*

[32] For these cases, only the name of the drug was given with no qualification of the amount, either categorical or numerical.

4 Discussion

4.1 Assessment of outcomes from this project

The main purpose of this project was to explore the application of the NPSAD coding to the toxicology data and what results could be produced. The coding was successfully applied to toxicology data from fatalities in collisions between 2014 and 2018, and fatalities were classified into ten drug groups.

As well as distinguishing generally between medications and drugs of abuse, the groups used also distinguish between drugs which could affect cognitive behaviour and those that do not. This could be particularly useful for understanding the role a drug may or may not have had in a contributing to a collision. For example, the most commonly detected drug group was 'Non-psychoactive medications' but drugs in this group are unlikely to have contributed to the collision.

A particular point of interest in this work was those drugs which can be both medically administered and abused (ketamine, morphine, fentanyl, alfentanil). Of the 2,910 fatalities with at least one drug detected, 16% (454 fatalities) had one of the above drugs detected where it was not possible to ascertain whether it had been abused or medically administered; many of these (148 fatalities) were aged 60 or over. Initially 23% of fatalities with drug data had one of these drugs detected but further analysis looking at the combinations of drugs detected led to some of these fatalities being removed from the 'Query psychoactive drugs' group as it was deemed that the query drug in question had been medically administered. This shows that drug combinations can be used to an extent to classify detections of drugs such as ketamine.

The point discussed above was considered of interest because of the effect it might have on the ability to accurately produce statistics about the number of fatalities involved in collisions whilst over the drug driving limits. However, this work has highlighted another challenge in this area; some drugs in the driving legislation (particularly ketamine, cocaine, morphine and MDMA) have large proportions of drug detections in drivers which are recorded without a numeric level. This means that it could be hard to accurately assess what proportion of fatalities were over the legal limit for some drugs. Even those drugs with the highest numeric level report rates have no numerical level recorded for approximately 20% of fatalities where the drug is detected.

The benefits of analysing the toxicology data more widely than just focusing on drug driving limits was highlighted by the further analysis into psychoactive drugs. This analysis highlighted the relatively common detection of sedating antihistamines in road traffic fatalities and two thirds of these detections were in drivers. These drugs are not included in legislation and are mostly available over the counter so are not considered particularly strong by the public. Results such as this could be useful to DfT in informing future policy or campaigns.

The analysis of the drug groups in conjunction with Stats19 highlighted results such as the higher numbers of older fatalities with psychoactive medication drugs detected and younger fatalities with drugs of abuse detected. Again, findings like this could help DfT formulate targeted campaigns to prevent deaths as from drug driving.

Overall, the representativeness analysis did not highlight any obvious or concerning gaps or bias in the toxicology data that has been collected up to this point. As expected, drivers and riders had the highest availability of drug data and these road user types are also more likely to have numerical drug data recorded. There was variation between countries; in Scotland drug detections are most likely to be recorded with both a numeric and a descriptive level whereas in England they are more likely to be recorded with a descriptive level only.

4.2 Possible next steps

The analysis of toxicology data presented here has shown the potential value of this data and the results that can be derived from it. Caroline Copeland has advised that, now that the NPSAD coding has been set up to use the data collected for this project, the process of classifying the drugs in the dataset collected would be easily repeatable for future years of data.

It is recommended that this be included in the scope for the next contract for this work so that some degree of toxicology analysis can become part of the annual reporting process. Also, if drug data is routinely classified using the NPSAD coding, this will enable DfT to easily request ad hoc analyses if there are particular topics of interest (such as the prevalence of sedating antihistamines and other substances of concern).

The other issue which this work sought to address was the classifying of ambiguous drugs such as ketamine. This work has shown that it is possible to an extent to determine whether these drugs were abused or medically administered by examining the combination of drugs detected but it is recommended that some changes could potentially be made to the way these drugs are recorded in the TRL database in the future. In particular, when data from the toxicology report is entered into the database, it could be noted whether the interpretation on the report indicates the ketamine (or other drugs in the 'Query psychoactive drugs' category) was likely to have been medically administered.

The recommendation made above clearly depends on the level of detail on the toxicology reports which we receive. Therefore, further feasibility study work should be carried out to review a sample of toxicology reports to assess what proportion of the reports with query drugs recorded have sufficient extra information recorded to indicate whether the drug was medically administered. This task was not possible as part of this project (because of the COVID-19 pandemic restricting access to the TRL office) but it may be possible in the future as a larger number of L407 forms and toxicology reports are now held electronically (approximately 80% of forms for 2019 fatalities were received electronically)and access to the office may become easier and national restrictions are eased.

The representativeness analysis highlighted some police force areas for which the sample of toxicology data received was lower; however, there was a good return of data for the majority of road user groups, with more returns for drivers than passengers and pedestrians. It would still be useful to further understand how the toxicology data is collected and in what circumstances drug testing is carried out and for what drugs. It would be of particular interest to engage with both coroners in England and Scottish Fatal Investigation Units (SFIUs) in Scotland to understand the slight difference in the way in which drug detections are recorded. Understanding why some drugs are recorded with numeric levels and some with descriptive

levels would also provide insight into how the toxicology data can be used to accurately produce statistics about fatalities with drugs detected above the legal limit for driving.

Data is also available in the UK on drug driving offences and self reported behaviour, as reported in the recent PACTS report[33]; however, police data should be treated with caution since the amount of resource used for enforcement, how this varies between forces, whether it is targeted and over time will affect the number of offences. The 2017 evaluation of drug driving laws showed that blood tests for those arrested for drug driving showed that cannabis, cocaine (and Benzoylecgonine) were the most commonly detected. The number of driver offences detected is a very different measure than the incidence of drugs in fatalities, since the presence of drugs impair driving and are therefore more likely to result in a fatality.

It may also be useful to compare the data collected for GB fatalities as part of this study with other countries. For example in Australia a study found that approximately 20% of roadside drug tests conducted detected a positive result[34] and in Canada drugs were found in over one-third of fatally injured drivers who are tested[35].

[33] Drug driving – the tip of an iceberg https://www.pacts.org.uk/wp-content/uploads/PACTS-Drug-Driving-The-tip-of-an-iceberg-3.0.pdf

[34] The who, what and when of drug driving in Queensland: Analysing the results of roadside drug testing, 2015–2020 https://doi.org/10.1016/j.aap.2021.106231

[35] Prevalence and trends of drugged driving in Canada https://doi.org/10.1016/j.aap.2016.12.008

Appendix A Further analysis of psychoactive drugs

Table 22 shows the number of fatalities with each psychoactive drug detected. The rows are colour-coded to indicate which sub-category the drugs belong to. Places where drugs have been grouped and the total is shown are shown in bold italics.

- Drugs already listed in legislation
- Z-drugs
- Sedating antihistamines
- Other substances of concern

Table 22: Number of fatalities with psychoactive drugs detected (2014-18)

Psychoactive drug	Number of total fatalities	Number of driver fatalities
Cannabis	624	464
Cocaine (benzoylecgonine; cocaethylene)[36]	458 (325; 168)	319 (226; 113)
Morphine	244	153
Ketamine	233	144
Codeine[37] (with morphine)	195 (87)	128 (59)
Diazepam	183	108
Sedating antihistamines (total)[38]	***98***	***60***
Tramadol	92	65
Amphetamines	87	63
Temazepam	76	53
Methadone	74	41
Oxazepam	57	38
MDMA	53	34
Dihydrocodeine	46	33
Z-drugs (total)	***40***	***29***
Zopiclone	38	28
Gabapentin	36	20
Heroin	36	20
Pregabalin	28	18

[36] Benzoylecgonine and cocaethylene are not drugs administered in their own right as they are by-products of cocaine (cocaethylene forms when cocaine and alcohol consumed together)

[37] Cases that cannot be attributed to heroin administration

[38] Fatalities with at least one sedating antihistamine detected

Psychoactive drug	Number of total fatalities	Number of driver fatalities
Cyclizine	24	11
Fentanyl	23	15
Unspecified benzodiazepine[39]	23	16
Chlorpheniramine	21	11
Promethazine	20	13
Hydroxyzine	19	16
Nordiazepam[40]	16	11
Buprenorphine	15	5
Diphenhydramine	15	10
Mephedrone[41]	15	10
Unspecified opiate[42]	13	6
Alprazolam[43]	12	5
Pentobarbitone[44]	12	4
Phenethylamine	11	5
Chlordiazepoxide	10	1
Etizolam	10	5
Oxycodone	10	4
Nitrazepam	9	5
Hydrocodone	9	9
Barbiturates (other)	7	4
Lorazapam	7	3
Methamphetamine	7	4
Clonazepam	3	1
GHB[45]	3	2

[39] Likely many of these are the urine dipstick result upon A&E admission

[40] A metabolite of diazepam/chlordiazepoxide

[41] Not flagged as a concern as mephedrone use has dropped in recent years

[42] Likely many of these are the urine dipstick result upon A&E admission

[43] Flagged as concern because use of this is increasing, especially in known drug users

[44] Can be used in emergency medical treatment but is still prescribed for epilepsy and insomnia. Classed as a psychoactive medication in this analysis (if classed as a medical treatment no further query drug cases can be reclassified to likely administered as a medical treatment)

[45] All these detections are likely from post-mortem production based upon levels detected

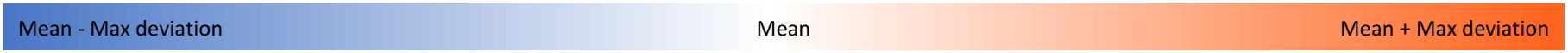
Psychoactive drug	Number of total fatalities	Number of driver fatalities
Zolpidem	3	2
Alfentanyl	2	2
Butane	2	1
Cinnarizine	2	1
Modafinil	2	1
Phenazepam	2	2
Phenobarbitone	2	2
Primidone	2	1
3-FPM	1	1
4-chloroethcathinone	1	1
4-Methylethcathinone	1	1
Cathine	1	1
Delorazepam	1	1
Hydromorphone	1	1
Methylphenidate	1	0
Mexedrone	1	1
MPA	1	1
Tapentadol	1	1
Flunitrazepam	0	0
LSD	0	0
Total fatalities with psychoactive drugs	**1,625**	**1,094**

Appendix B Further results for the representativeness analysis

This appendix shows extended data from the representativeness analysis in Section 3.

Some cells in the tables in this section have been shaded to highlight outliers from the mean value. The shading is done separately for each column using the following method:

Cell shading key:



For each column, 'max deviation' is defined as the number of percentage points between the mean percentage value for the column and the highest or lowest percentage value in the column (whichever is further from the mean).

B.1 Year

Table 23: Extended summary of fatalities with BAC and drug information by year (2014-18).

Year	No. in Stats19	No. with L407	% of Stats19	No. with BAC	% of Stats19	No. with drug data	% of Stats19
2014	1,722	1,361	79%	1,046	61%	852	49%
2015	1,676	1,357	81%	1,059	63%	914	55%
2016	1,723	1,446	84%	1,048	61%	1,009	59%
2017	1,745	1,501	86%	1,098	63%	1,097	63%
2018	1,736	1,496	86%	1,108	64%	1,054	61%
Total	**8,602**	**7,161**	**83%**	**5,359**	**62%**	**4,926**	**57%**
Max deviation			*4%*		*2%*		*8%*

B.2 Police force area

Table 24: Extended summary of fatalities with BAC and drug information by police force area (2014-18).

PF	PF Name	Country	No in Stats19	No. with L407	% of Stats19	No. with BAC	% of Stats19	No. with drug data	% of Stats19
94	Fife	Scotland	45	42	93%	42	93%	42	93%
34	Northamptonshire	England	153	139	91%	130	85%	133	87%
93	Tayside	Scotland	89	85	96%	78	88%	77	87%
32	Lincolnshire	England	242	226	93%	198	82%	199	82%
31	Nottinghamshire	England	140	133	95%	113	81%	115	82%
37	Suffolk	England	144	133	92%	122	85%	118	82%
92	Grampian	Scotland	111	100	90%	95	86%	90	81%
30	Derbyshire	England	178	173	97%	138	78%	143	80%
47	Sussex	England	229	216	94%	167	73%	171	75%
53	Gloucestershire	England	129	125	97%	95	74%	94	73%
96	Central	Scotland	42	31	74%	30	71%	30	71%
45	Surrey	England	156	144	92%	114	73%	109	70%
95	Lothian & Borders	Scotland	128	95	74%	88	69%	89	70%
36	Norfolk	England	161	137	85%	114	71%	107	66%
97	Strathclyde	Scotland	255	204	80%	169	66%	168	66%
35	Cambridgeshire	England	183	171	93%	130	71%	120	66%
13	West Yorkshire	England	242	190	79%	158	65%	158	65%
44	Hampshire	England	237	207	87%	162	68%	153	65%
42	Essex	England	236	231	98%	148	63%	152	64%
55	Dorset	England	100	91	91%	71	71%	63	63%

PF	PF Name	Country	No in Stats19	No. with L407	% of Stats19	No. with BAC	% of Stats19	No. with drug data	% of Stats19
33	Leicestershire	England	180	152	84%	128	71%	113	63%
10	Northumbria	England	147	134	91%	98	67%	92	63%
98	Dumfries & Galloway	Scotland	56	42	75%	36	64%	35	63%
54	Wiltshire	England	141	122	87%	93	66%	87	62%
16	Humberside	England	132	115	87%	86	65%	81	61%
3	Cumbria	England	133	114	86%	86	65%	80	60%
62	South Wales	Wales	134	108	81%	82	61%	80	60%
52	Avon & Somerset	England	242	224	93%	157	65%	143	59%
7	Cheshire	England	172	144	84%	98	57%	101	59%
21	Staffordshire	England	150	139	93%	115	77%	86	57%
40	Bedfordshire	England	96	79	82%	63	66%	55	57%
14	South Yorkshire	England	193	163	84%	116	60%	110	57%
63	Dyfed-Powys	Wales	147	139	95%	101	69%	82	56%
91	Northern	Scotland	104	101	97%	89	86%	56	54%
50	Devon & Cornwall	England	252	225	89%	156	62%	135	54%
43	Thames Valley	England	374	351	94%	225	60%	199	53%
46	Kent	England	262	182	69%	132	50%	131	50%
23	Warwickshire	England	150	147	98%	102	68%	73	49%
12	North Yorkshire	England	185	129	70%	100	54%	90	49%
11	Durham	England	100	82	82%	60	60%	43	43%
22	West Mercia	England	230	220	96%	143	62%	98	43%
60	North Wales	Wales	144	115	80%	77	53%	61	42%
4	Lancashire	England	211	184	87%	110	52%	85	40%

PF	PF Name	Country	No in Stats19	No. with L407	% of Stats19	No. with BAC	% of Stats19	No. with drug data	% of Stats19
17	Cleveland	England	33	20	61%	17	52%	13	39%
6	Greater Manchester	England	245	172	70%	116	47%	96	39%
5	Merseyside	England	113	80	71%	43	38%	41	36%
20	West Midlands	England	263	160	61%	92	35%	94	36%
41	Hertfordshire	England	125	102	82%	63	50%	42	34%
1	Metropolitan	England	603	329	55%	201	33%	193	32%
48	City of London[46]	England	4	0	0%	0	0%	0	0%
61	Gwent	Wales	81	14	17%	12	15%	0	0%
Total			**8,602**	**7,161**	**83%**	**5,359**	**62%**	**4,926**	**57%**
Max deviation					*83%*		*62%*		*57%*

[46] The City of London police force were not contacted by TRL to request fatality names and therefore the coroners were not asked to provide data for these cases

B.3 Road user type

Table 25: Extended summary of fatalities with BAC and drug information by road user type (2014-18).

Road user type	No in Stats19	No with L407	% of Stats19	No with BAC	% of Stats19	No with drug data	% of Stats19
Goods vehicle driver	241	211	88%	182	76%	168	70%
Motorcycle rider	1,662	1,410	85%	1,220	73%	1,128	68%
Car driver	2,754	2,421	88%	1,991	72%	1,812	66%
Goods vehicle passenger	53	45	85%	33	62%	30	57%
Pedestrian	2,090	1,634	78%	1,130	54%	1,040	50%
Pedal cyclist	488	386	79%	244	50%	216	44%
Other driver	125	103	82%	59	47%	53	42%
Car passenger	1,079	867	80%	455	42%	437	41%
Other passenger	49	39	80%	20	41%	19	39%
Motorcycle pillion	61	45	74%	25	41%	23	38%
Total	**8,602**	**7,161**	**83%**	**5,359**	**62%**	**4,962**	**57%**
Max deviation			*9%*		*21%*		*20%*

Toxicology data analysis feasibility study

This report presents the results of work done to explore how Department for Transport (DfT) can best understand and use the drug toxicology data for road traffic fatalities collected by TRL from coroners and procurators fiscal in Great Britain.

This work classified drug detections for fatalities in collisions between 2014 and 2018 into ten drug groups using existing coding developed by the National Programme for Substance Abuse Deaths. The categorised drug data was then analysed further to explore those results which could be derived and be of use to DfT. There was a particular focus on drugs which can be both medically administered and abused and how the combinations of drugs detected can be used to determine whether these ambiguous drugs had been abused or administered as part of emergency medical treatment. Representativeness analysis was also carried out to identify any potential gaps or bias in the toxicology data currently collected.

The project found that classifying fatalities into the ten groups in the NPSAD coding enables analysis of the toxicology data to derive meaningful findings, of potential use to DfT in informing policy or targeting campaigns. Some challenges have also been highlighted and recommendations have been made for addressing these and for using the drug toxicology data in the future.

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